

OBJECTIVES and STRATEGIC RESEARCH DIRECTIONS of DFCTI 2024-2030

Computational physics and IT applied to the study of subatomic and condensed matter

BACKGROUND

The development and implementation of new numerical methods and algorithms to support research in the fields of subatomic physics and condensed matter, the design of electronic nanodevices and the analysis of the human genome are currently evolving rapidly, thanks to the accelerated progress of experimental technology and computational techniques. The objectives of the National Research and Innovation Strategy (SNCISI) for the next years include supporting research in the field of nanomaterials for applications in electronics and sensors for the detection of biomarkers, the use of Big Data technology in genomics, and the development of digital repositories for the transition to open science. Capitalizing on its own Grid, Cloud, HPC and Big Data computing infrastructure, as well as its expertise in advanced IT technologies, in the application of automatic learning and ab-initio computing techniques for the modeling of nanodevices and nanosensors, in the simulation of biomolecular systems and the analysis of genomic data, DFCTI will further develop the research themes corresponding to the SNCISI's objectives listed above.

OBJECTIVES

- Equipping DFCTI's Advanced Computing Center with top-performing ICT resources, to ensure the computational support for the institute's R&D activity.
- Development of the advanced computing infrastructure, the extension of the application of Cloud technologies and the management of Big Data, to meet the requirements of the Worldwide LHC Computing Grid (WLCG) and European Open Science Cloud (EOSC) collaborations
- Carrying on international cooperation with relevant institutions and bodies (such as EGI, CERN) and the participation in European RDI / ICT projects and initiatives.
- Integrating the digital repository of public scientific data of the Institute into the European infrastructure for open science.
- Leveraging expertise in the field of advanced computing technology and cybersecurity through knowledge transfer to partners from the scientific and economic environment.

MAIN RESEARCH DIRECTIONS

- Investigating the properties of subatomic systems through computational physics methods.
- Numerical prediction of the properties of metamaterials, graphene-type materials and biomolecules connected to inorganic systems, using ab-initio and machine-learning methods.
- Investigating complex biomolecular systems through numerical modeling and simulation.
- Development of IT services and applications to support the analysis of next generation sequencing (NGS) data.
- Contributing to the development of the national quantum communications network.
- Accumulation of know-how and development of numerical methods and algorithms for new applications and technologies.

CONCLUSIONS

DFCTI's priorities for 2024-2030 aim at strengthening the scientific profile of the department and implementing the latest generation computing infrastructure to support the institute's major research programs, in order to achieve the goal of leadership in information technology expressed in the IFIN-HH's Strategy.